Energy and Water in Mongolia: What are Japan's Roles?[1]

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Abstract

Today, many Asian countries have developed the strategy for economic growth. In particular, economically emerging countries have achieved strong economic growth by exporting their natural resources. Thus, this kind of economic growth strategy in these states has caused great environmental damages, although economic development and the environment are closely related. In 2014, the Asian Development Bank (ADB) issued a report about Mongolia's water - energy - mining nexus. It showed the importance of the relationship between economic development and environment, "no water, no economic development." However, the Mongolian government tends to ignore water strategy and technology, while they advance the development of mining for economic growth and energy policy for self-reliance. As a case, the Mongolian government promotes oil shale production plans despite the risk of pollution of groundwater. Moreover, it lacks enough technologies and funds to develop mining and conserve water resources. Therefore, to stabilize resource transactions, protectors of water resources are required. Japan with its high technologies of water resources can play an important role in conservation of water resources. In this paper, I consider that the conservation of water resources in Mongolia would lead to profits in Japan's diplomacy and economic strategy.

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1. Introduction

In 2014, the Asian Development Bank (ADB) issued a report titled "Demand in the Desert Mongolia's Water - Energy - Mining Nexus." In this report, ADB stated, "The water-energy nexus is the interdependency between water systems and energy systems." [2] It pointed out that the development of electric power and mining resources requires water. The mining operations for coal, the main industry of Mongolia, require a lot of water. Fired power stations, which use coal, also need water for thermal electric cooling. However, water also demands energy for pumping, water treatment, wastewater treatment, transport, distribution and water system development. ADB's report suggests that we need to think about the relationship between water resources and mining production of Mongolia that became a major exporter of mining resources in Northeast Asia. This has important implications for Japan. Destabilization of coal production in Mongolia by reduce of water supply leads to rise international price of coal. As Japan has no energy resources, the rise in international prices of such energy items as oil, natural gas and coal is a major problem for the Japanese economy. Therefore, what can Japan do to prevent such effect? In this paper, I consider the involvement of Japan to energy politics in Northeast Asia by analyzing the relationship of Mongolia's energy policy and water supply.

2. Situation of Energy in Mongolia

Before the beginning to discuss the relationship between energy and water, we need to examine the current status and issues of Mongolian energy. In order to analyze the more detailed at current situation of Mongolia's energy policy, we shall begin with the indicators about Mongolia of energy summarized by the U.S. Energy Information Administration (EIA).[3] In EIA statistics, we can see the index of Mongolia's production and consumption of oil, natural gas and coal from 1980 to 2013.

Mongolia has a superior position in mining, especially coal. It has become an important exporter of natural resources in Northeast Asia. Mongolia is expanding production and export of coal as national policy.[4] Coal production volume is considerably higher than the consumption; According to the EIA's statistics, coal production in Mongolia was 37 million short tons and coal consumption was about 11 million short tons in 2012. Mongolia is thus self-sufficient for coal and has been exporting it in a rapidly expanding volume since 2008. The export volume was about 5 million short tons in 2008, 8 million in 2009, 18 million in 2010, 26 million in 2011 and 24 million in 2012. In share of Mongolia's main export commodities, coal is the first with 26.3%. The expansion of production and export of coal has prompted Mongolia's economic development: its GDP growth rate has been rising along with its coal export, from 6.4% in 2010 to 17.5% in 2011, 12.3% in 2012 and 11.7% in 2013.[5]

However, Mongolia's present production of oil and natural gas differs from its mining of coal. According to the EIA's statistics, Mongolia produced 14,000 barrels per day of crude oil in 2013. Although Mongolia had produced almost no crude oil until 1997 and saw no growth of production from 1998 to 2006, its production grew rapidly afterward. Its oil consumption also has grown since 2000, from 8,000 barrels per day in 1997. The growth of consumption since 2010 is just as sharp as the growth of production. By 2013, Mongolia was consuming 25,000 barrels per day. In the oil balance sheet of Mongolia, domestic demand and consumption are larger than production volume. The oil balance sheet shows greater the consumption than production. Therefore, Mongolia relies on oil imports. In fact, petrol products such as diesel fuel and gasoline account for an extremely high share of imports into Mongolia at 27.8% (in monetary terms). Furthermore, in commodities, diesel fuel and gasoline fuel account for first and second positions in the product category share (13.9% and 6.9% respectively).[6] Russia is Mongolia's main oil fuel exporter, taking 83% of its diesel fuel and 59% of its gasoline fuel. Mongolia produces no natural gas. Therefore, Russia has controlled Mongolia's energy.

In short, the energy situation of Mongolia today depends on coal. Therefore, when considering state's energy policy, it is not difficult to imagine that Mongolia would aim to diversify energy sources in order to increase domestic production and reduce foreign imports (largely from Russia and China). In fact, the Mongolian government is doing so. For example, the Minister of Mineral Resources and Energy of Mongolia made ambitious remarks on the development of Mongolian domestic shale oil and gas when he visited Japan in 2012.[7] In 2013, the Petroleum Authority of Mongolia entered into a five-year agreement with Genie Energy Ltd. to develop 800 billion more tons of oil shale domestically.[8] Mongolian oilfield development, including shale oil, will surely accelerate more than ever. Moreover, The Petroleum Authority of Mongolia signed an agreement for additional oil shale exploration with Genie Energy.[9] However, these policies are likely to pollute water and cause shortages of water, including drinking water.

3. Water Situation in Mongolia

Mongolia aims to keep expanding coal production, which has become a source of wealth, but to expand energy security, it also promotes the production of domestic oil. What impact will this energy policy have on water conditions in Mongolia?

To understand Mongolia's water situation, we could see Mongolia's data from AQUASTAT that is the water database made by the Food and Agriculture Organization of United Nations (FAO).[10] Mongolia's climate is the subarctic and steppe climate, and most of its land is arid and semi-arid. The Gobi Desert is located in southern Mongolia, getting dryer as one goes south, which means water is scarce. Its average precipitation is 241 mm per year, far less than the world average 880 mm, Japan's 1,668 mm and the United States of America's 715 mm. Moreover, because of dryness, 90% of rainfall is lost to natural evaporation. Mongolia's Internal Renewable Water Resources[11] is 34.8 billion ㎥, less than Japan's 430 billion ㎥ and the United States' 2,818 billion ㎥. However, it is livable for Mongolians because the population of Mongolia is extremely small. The United States has 320 million people and Japan 127 million people, but Mongolia just 2.84 million people. Therefore, total actual renewable water resources per inhabitant (usable water per capita) of Mongolia is 12,258 ㎥, versus America's 9,589 ㎥, Japan's 3,382 ㎥ and the world's 8,600㎥. The United Nations Department of Economic and Social Affairs (UNDESA)'s website indicates Mongolia as the area of "little or no water scarcity." [12]

Let us consider shale oil development. To extract shale oil, we frack the shale, using plenty of water. This method is called "hydraulic fracturing" or "hydrofracking."[13] To mine one barrel of shale oil, on average, five barrels of water is used, with as many as twelve barrels sometimes require. It might be possible to reduce the amount of fresh water by recycling water that was used in hydraulic fracturing, to one barrel water per barrel of oil.[14] Thus, the mining of the oil shale needs a great deal of water. When converted to cubic volume (1 barrel = 0.158987 ㎥), fresh water is used 0.794935㎥ to 1.9㎥ per barrel. Further, according to EIA statistics, oil consumption per day in Mongolia is about 25,000 barrels. To replace this consumption volume with shale oil mined in Mongolia would take 19,873 - 47,500㎥ of water per day, and 7.25 million - 17.33 million㎥ per year. In total actual renewable water resources per inhabitant, this amount of water only supplies 590 to 1,400 people. Furthermore, recycling can reduce the amount of water used. Thus, if calculated roughly and considering in a total volume of water resources, it appears enough water for oil shale development in Mongolia.

However, to be precise, this is not correct. Total actual renewable water resources per inhabitant should not be the only calculation on the desk. Its volume is the total of unevenly distributed, domestic water resources divided by the population. It is important how much water is available. According to FAO, the amount of actually usable water per capita in Mongolia is 197 - 208㎥ since 2001, less than 1.5% of 12,258㎥ in total actual renewable water resources per inhabitant. In other words, the amount of water actually used is less than 1.5% of Mongolian domestic water resources. Actually usable water per capita in the United States is 1,575㎥ (16.4%) and Japan is 713㎥ (21%). The divergence between total actual renewable water resources per inhabitant and real water use per capita in Mongolia is very large. Thus, the actual available amount of water in Mongolia is very small. This reason seems to be its underdeveloped water infrastructure. Then, under the premise that Mongolia's water resources are fragile currently, we need to proceed with discussion.

Moreover Mongolia has a distorted water problem. About 1.4million of 3million people of Mongolia's population live in Ulaanbaatar city.[15] Its water source is groundwater, introduced by seven wells, which can bring maximum 280,000 ㎥ per day. Today, Ulaanbaatar city brings in a daily average of 150,000 - 160,000㎥ . Although water supply capacity exceeds the demand for now, in the future, this balance will be lost. Because, the water demand of Ulaanbaatar city, where 46% of the total population is concentrated, will increase rapidly by economic development of Mongolia.[16]

Currently, Mongolia has been solved the problem of less water resources by small population. Additionally, most of water source of Ulaanbaatar city, where 46% of the total population, is concentrated is groundwater. Therefore, Mongolia is the state that is dependent on groundwater excessively. For two reasons, water supply of Mongolia is vulnerable to population growth or depletion and pollution of groundwater. In fact, annual population growth rate of Mongolia in the past few years has been about 1.8%.[17] Mongolia's population is steadily increasing. This means a steady increase in water demand. Then, if situations to reduce the water supply, especially depletion and pollution of groundwater will happen, Mongolia's water supply will be exacerbated at once. So we need to pay attention to cases that affect to groundwater in Mongolia.

4. Relationship between Water and Energy in Mongolia

Cases that influences the groundwater in Mongolia might be policies that Mongolian government aims at the independence of the energy supply. Because energy developments that Mongolian government plans have an impact on domestic water environments.

The ADB report notes that expanding the power supply by increasing economic development and coal production increases the need for water. According to the ADB report, generating electricity for one megawatt per hour consumes 242 - 4,163 liters of water per year, though this figure changes as technology changes.[18] In 2013, all coal-fired power generation facilities in Mongolia consumed about 27 million㎥ of water per year.[19] Additionally, Mongolia's power demand is expected to increase more than fivefold by 2030.[20] The report also states, "Water is essential to the extraction and cleaning processes associated with primary energy production," and notes water consumption for coal production. It also says that water consumption for coal extraction is 150 - 2,000 liters per ton.[21] Currently, coal production in Mongolia has not expanded rapidly for the past few years, but it seems that the Mongolian government would intend to maintain or slowly expand its production scale. If so, it is clear that water demand for coal production and coal-fired thermal power plants in Mongolia would continue to increase continuously.

In addition, Mongolia intends to develop oil shale in order to increase national energy security. Although the contract principal is the Petroleum Authority of Mongolia, the CEO of Genie Energy Ltd. has made clear that the Mongolian government, including the Ministry of Mining, has been involved in the contract.[22] Therefore, the importance of water is further increased by the context of the shale oil. As calculated above, if replacing the current oil consumption of Mongolia with shale oil, approximately 7.25 million - 17.33 million m^3 of additional water will be required per year.

If oil demand in Mongolia will be increased by economic development, this will be even further enhanced water demand. More importantly, there is the difference between “shale oil” and “oil shale.” “Oil shale” is a substitute for “shale oil” and also called “kerogen,” and generating it requires enough heat to extract fuel liquids. Hydrofracking directly takes “shale oil” out from shale. “Oil shale,” after hydrofracking, is produced by further heating and liquefying extracted shale rock containing oil. This calls for far more water than “shale oil.”[23] Energy plans that Mongolia is currently developing are “oil shale.”

Furthermore, increase in water demand is not only due to coal-fired power generation and coal and oil shale production but also due to water pollution. Environmental destruction caused by economic development, including the pollution of water, is rampant around the world. However a new form of water pollution can be seen in the present of the United States. The United States is the most developed country of shale oil and gas production and developments which have polluted its water. By searching on the Internet, we can find videos of yellow water coming out from the faucet and the flowing water flaring up when exposed to flame.[24] Chemicals mixed with water in mining flows into the groundwater, and cause serious water pollution. In particular, horizontal drilling of shale oil increases the probability of contamination significantly.[25] In this way, development of shale oil causes many cases of water contamination, and increases concerns. France has been prohibited domestic hydro fracking by law in 2011 to prevent destruction of agriculture and environment by the use or contamination of a large amount of water.[26] France’s constitutional council also upheld a ban on hydrofracking in 2013.[27] Furthermore, “oil shale” burdens the environment more than “shale oil.” Therefore, in Mongolia’s water resources which depend entirely on groundwater, pollution is an extremely deadly threat. Without strict management and complete purification, as a result, Mongolia will fall into a serious drinking water shortage. Production of oil shale in Mongolia has a large risk which contaminates water resources. If Mongolia will advance oil shale plans, it will be necessary for Mongolia to purify a large amount of contaminated water used in oil shale production.

As above, energy policies of Mongolia have a possibility of affecting the water supply. Additionally, existing mining productions also put pressure on water demands and supplies of Mongolia. Mongolia's energy security policy aims to reduce dependence on Russia and China, and economic growth by mining production tends to cause "water resource vulnerability." In fact, today, pollutions of water have been caused by small- and medium-sized mining companies that Chinese capitals dominates in Mongolia. These companies are performing illegal mining practices such as illegal drainage of polluted water, illegal digging and careless explosions that harm groundwater.[28] Mining productions that harm groundwater lead to decrease of water supply capability. To exceed such damage, it is necessary to consider the conservation of water resources. Without advanced water conservation and development strategies, independence and survival of Mongolia will have no future. Water resource conservation technologies, such as reclaimed wastewater technology are essential for stable supply of mining and energy.

5. Japan's Roles in Water Security of Asia

To increase energy production stably, Mongolia needs to prevent contamination of its water. Therefore, Mongolia needs to develop its water infrastructure, including reclaimed wastewater technologies, at the same time as it develops its energy supply. If Mongolia will neglect it, the amount of actually available water will further decrease due to increases of pollution and water demand that will be caused by energy development. Water and energy in Mongolia are inseparable. However, it seems unlikely that Mongolia will carry out the development of energy and water infrastructure at the same time, due to funding and technology problems. Therefore, Japan should get involved in the energy policy of Mongolia by providing Japanese water management technology.

Providing water management technology to Mongolia is in Japan's own national interest. Because destabilization or decrease of mining production volume, especially coal production volume, in Mongolia affect Japan through change in international market prices. As of 2013, coal provided approximately 41% of the world's electricity needs, and 29% of total world energy supply. Coal is second in its share of resources of world energy supply. The International Energy Agency (IEA) reports that coal will continue to occupy a key position as a major energy resources for several decades by increasing consumption of coal in the world.[29] As of 2013, the top three of coal importers are China (292 million tons), India (239 million tons) and Japan (188 million tons).[30] Coal's share of Japan's first energy supplies was also 25.1% as of 2013.[31] Thus, it has been a key energy resource for Japan. Moreover, since 2011, the Japanese government has stopped the operation of all domestic nuclear power plants by Fukushima Daiichi nuclear disaster in the Great East Japan Earthquake, consumption of coal has increased in Japan's first energy supplies, from 22.5% in 2010, to 23.4% in 2012 to 25.1% in 2013.[32] In this way, today, the importance of coal in Japan is growing. In such Japan's energy situation, coal production in Mongolia is important to Japan. Its reduction must be avoided for Japan.

Fortunately, Japan can support water management. Japanese companies have water treatment products using reverse osmosis membrane and neutralizer technologies.[33] Moreover, water treatment businesses of Japanese companies with these technologies have deployed abroad. For instance, the famous Japanese firm "TORAY," using the reverse osmosis membrane, has delivered and managed many large water treatment plants in China or Southeast Asian countries.[34] While Japanese private sectors have expanded such water businesses, the Japanese government has also helped other states in water-related fields for a long time. In Mongolia, Japanese grants have assisted the improvement plans of water supply facilities in Ulaanbaatar (1996, 1997, 1998, 2004, 2010 and 2011) and Darkhan (2009), and freshwater resources and natural protection plan (2010) in Mongolia.[35] The Japanese government has established a policy of assistance for Mongolian development since 2012. This policy has three priority areas: 1) strengthening sustainable development and governance of mineral resources, 2) supporting growth that can benefit all people and 3) strengthening Ulaanbaatar's urban function.[36] These improvement plans for water supply facilities indeed seem to have strengthened Ulaanbaatar's urban function, raising the Mongolian living standard, because the population of Ulaanbaatar is 1.37 million people, which correspond to almost half of Mongolia's population.[37] If the improvement of water supply in Ulaanbaatar City could help to increase the amount of water available to the Mongolian people, Japan should continue to strengthen such aid. It is impossible for Mongolia to promote their energy developments without water management. If Japan will expand its aids, Mongolia will be able to sustain their capacity of water supply in quality and quantity while strengthening the development of mineral resources, especially coal. Moreover, if Mongolia will carry out plans for oil shale development, Japan should actively provide equipment and technology that recycle and purify water used to mine oil shale. Thereby, this would integrate water management policy with energy policy. At the same time, Japan would become an actor in international politics of energy.

More importantly, states that have problems that mining factor and water factor are intermingled are not only Mongolia. There are many states such as Mongolian situation in the world, especially, in Eurasia landlocked and central Asia. Some states in Central Asia have rich mineral resources. For instance, there are gold and natural gas in Uzbekistan; gold in Kyrgyz; mercury and aluminum in Tajikistan; and, gold, copper, lithium, natural gas and coal in Afghanistan. These states also look to mining and energy development to develop their economies. However, the geology of Central Asia states has many significant toxic minerals. This means that strategies and technologies which protect water resources is essential for these states more than Mongolia. Moreover, in these states, water is more insufficient than Mongolia. If Japanese contribution to the water security of Mongolia will achieve a great success, this Japan's movement will make possible to deploy toward the Central Asia. For that end, supports regarding water treatments are important for Japanese own interest.

6. Conclusion

We could find several points in analyzing current Mongolia. First, Mongolia has promoted domestic economic development by developing mining production, and become an important actor of energy politics in Northeast Asia. Recently, high economic growth of emerging countries including China and India has caused rapid increase of global demand for coal and raised coal's market price. The rising of coal's price is a main motive power of Mongolian economic growth. However, at the same time, this leads to rapid growth of water demands in Mongolia. Second, although Mongolia is facing rapid growth of water demand and the development of its water infrastructure is not progressing, as the amount of available water per capita, 197 - 208m^3 annually, has shown, Mongolia is able to manage the water supply today, because of the small population. Third, changes in the balance between supply and demand for water in Mongolia due to energy developments including oil shale jeopardize not only the sustainability of energy development but also Mongolian people's lives. As Mongolia is advancing the development of rich mineral resources domestically and not emphasizing development and protection of water resources, as a result, the threat that water supply capacity in Mongolia would be reduced might grow more endangered. If decrease of coal production in Mongolia by reduction of water supply would cause, it might affect the energy supply of Japan through rising of coal's market price.

To prevent the realization of anxiety of the third point and sustain energy security in Asia, Japan should actively introduce water-management techniques and technologies to Mongolia. This would contribute to not only Mongolian water security but also Japanese own interest. Since 2011, Japan has be increased energy dependence on coal. Japan has no mining resources but many water technologies. Japanese water system and technology can become strategic resources with the same values as mining resources. If, moreover, Japan would provide similar supports to states of Central Asia with such conditions as Mongolia, Japan might become a key agent in the energy politics of Northeast and Central Asia. This is very important for Japan without energy resources. As a first step that is externalized its initiative, Japan should take advantage of environment situations in Mongolia and other Asian states.

Notes

1 This paper is revised and summarized from the contents of author's speech in the forum, ***International Politics of Energy in Northeast Asia; From Mongolia to Japan***, given in Kyoto, Ritsumeikan University, on January 17, 2015.

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3 U.S. Energy Information Administration website, http://www.eia.gov/countries/ (Latest access: March 1, 2016.)

4 Mongolian government, in 2010, established the National Security Concept, in which, has set the expansion of the use and export to overseas of domestic coal. For more information, refer to the following website. http://www.meti.go.jp/meti_lib/report/2012fy/E002591.pdf (Latest access: March 1, 2016.)

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10 FAO website, AQUASTAT http://www.fao.org/nr/water/aquastat/countries_regions/MNG/index.stm (Latest access: March 1, 2016.)

11 Internal Renewable Water Resources is the amount that minus the amount lost by evaporation from the precipitation, indicating the amount of water resources for human available.

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17 The World Bank website, http://data.worldbank.org/indicator/SP.POP.GROW/countries/MN?display=graph (Latest access: December 21, 2015.)

18 ADB, *Op.Cit,* p.15.

19 ***Ibid,*** p.16.

20 ***Ibid,*** p.14.

21 ***Ibid,*** p.17.

22 Genie Energy Ltd. website

23 United Nations University website.

24 American documentary movie "GAS LAND" which was produced in 2010 is famous as those depicting the reality of water pollution by Hydraulic fracturing of shale oil development and gas.

25 Marubeni website, http://www.marubeni.co.jp/news/2014/info/Diamond140902SS.pdf (Latest access: March 3, 2016.)

26 *FINANCIAL TIMES* website, May 11, 2011. http://www.ft.com/cms/s/0/907fd72c-7c06-11e0-9b16-00144feabdc0.html#axzz3UYkU5fCY (Latest access: March 3, 2016.)

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- United Nations University

・U.S. Energy Information Administration
・World Bank
・World Coal Association